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REMARKS

ON

MR. ROBERT STEELE'S

REPORT

TO THE

CHAMBER OF COMMERCE OF GREENOCK,

ON THE

BILL NOW BEFORE PARLIAMENT

FOR THE

MEASUREMENT OF TONNAGE.

BY A MEMBER OF THE LATE COMMITTEE.

LONDON:
JOHN MURRAY, ALBEMARLE STREET.

1834.

REMARKS

ON

MR. ROBERT STEELE'S REPORT.

SINCE the publication of the Report of the late Committee, appointed by His Majesty's Government to consider the Measurement of Tonnage, several unconnected remarks concerning it have appeared, which, however, did not seem to require notice. But a formal Report on the Bill now lying before Parliament having been drawn up by Mr. Robert Steele, Builder, for the Chamber of Commerce of Greenock, by whom it not only has been approved, but made the ground of a Petition to Parliament, it becomes necessary to examine his objections to the rule proposed by the Committee, set forth, as they are, with an acuteness and plausibility that might leave a cursory reader altogether in error as to the nature of the rule itself as well as to its probable effects.

On one point, indeed, making *capacity* the basis of all measurements for tonnage, opinion is all but unanimous; and we need, therefore, add nothing further concerning this principle, which, when a vessel is to be built of a given magnitude, leaves the builder entirely free in his choice of the form. It seems also generally admitted that *internal* measurements are the most convenient: but opinion is much divided as to the proper number of measurements, and also as to the rule by which they are to be combined; that is, opinion is divided both on the degree of accuracy which should be attained, and on the means of obtaining it. On both these points, Mr. Steele differs from the Committee,

but without shewing that the results of his own method will be more accurate than theirs, or that the method itself is more free from defect. In the following remarks on his principal objections against the rule of the Committee, it will not be difficult to shew that they are either of no importance, or altogether fallacious, and that, in consequence, the tendency of the rule is misrepresented; that in its construction the Committee took that middle course which, in such mixed questions, it is so desirable to preserve, and on which it is always so difficult to agree, between unnecessary refinement on one hand and slovenly inaccuracy on the other*; that the operation of the rule will tend to improve the forms of merchant-vessels, and not to deteriorate them; and that, instead of raising the whole aggregate tonnage, it will rather depress it.

The Report of the late Committee shall first be re-stated, and the objections contained in Mr. Steele's Report subsequently considered:—

REPORT OF THE COMMITTEE *appointed by the Lords Commissioners of the Admiralty to consider the Measurement of Tonnage—made in* 1834.

THE most important question for the deliberation of the Committee was, whether the register tonnage should represent the difference of displacement at the load and light water-lines, or whether it should be an expression of the whole internal capacity, including all those parts of a vessel which, being under cover of permanent decks, are available for stowage. The Committee are of opinion, that, besides the difficulty of defining the limits of displacement by

* While many have insisted on the necessity of more numerous measurements, others, on equally good grounds, have condemned the proposed rule as already too complicated for general use. Mr. Seymour has represented to the Commissioners of Customs that one length, breadth, and depth are abundantly sufficient for all purposes.

any general rule, the capacity will be the fairest standard of measurement, as well for the interests of the builder and owner, as for the collection of those dues which are levied upon tonnage; and the Committee are further of opinion, that internal measurements will afford the most accurate and convenient method of ascertaining that capacity.

In order to obtain precise data for their investigations, the Committee requested to be furnished with the dimensions and actual capacities of a number of vessels of various sizes and forms, which were accordingly measured, and computed with great care and fidelity by Mr. H. Cradock, of the School of Naval Architecture. With these documents before them, as well as the several methods employed in foreign countries, and other formulæ of considerable merit, all of which are given in the Appendix, the Committee have finally resolved to recommend for adoption the rule No. 1, as hereafter stated.

The principle which guided the Committee in their selection was, that a rule of such general application should depend on the smallest number of measurements necessary to give the figure of the hull, and that it should afford results sufficiently exact for the required purpose by an easy arithmetical process.

But the tonnage thus found is not intended to shew the real capacity of the vessel, though bearing towards it nearly the same proportion which would result from the average of a large number of cases, on the application of the old and imperfect rule; for it appears to the Committee that the annual return of registered tonnage has been so long employed as a comparative index of the increase or decrease of British shipping, that it will be highly expedient to preserve the relative value of this index, as far as possible, unaltered. In order to accomplish this object, the Committee have had recourse to an arbitrary divisor, the mode of deducing which, from the latest official return to the House of Commons of

the "ships, vessels, and tonnage belonging to the several ports," is subjoined to this Report.

As every British vessel must be registered before she can receive a cargo, the Committee have assumed that the measurements will always be made while the hold is clear; but, as it will be necessary to ascertain the tonnage of foreign vessels, for light-house and harbour dues, while the cargoes are on board, the Committee have added for that purpose the approximate rule, No. 2, which will be found accurate enough for those cases.

Besides these two general rules, the Committee beg leave to offer the following suggestions:—

1. That the register tonnage shall be deeply carved in figures of at least three inches in length, on the main beam of every decked vessel of the United Kingdom.

2. That, as all British vessels have been constructed on the faith of the permanence of the present law of tonnage, so the tonnage of every vessel as now registered shall be allowed to remain unchanged, unless application be made by the owner to have it remeasured according to the new process.

3. That, in registering the tonnage of steam-vessels, instead of deducting the length of the engine-room, (according to the present mode,) an allowance shall be made of one-fourth of the whole tonnage, as obtained by rule No. 1. But the tendency of every improvement being to diminish the space occupied by the engine, some legislative provision might now be made, to enable his Majesty's government to alter the proportion of that allowance hereafter.

RULE No. 1.—*For the measurement of Vessels for Register Tonnage.*

1. Divide the length of the upper deck, between the after-part of the stem and the fore-part of the stern-post, into six equal parts.

2. At the foremost, the middle, and the aftermost of these points of division, measure, in feet and decimals, the depths from the underside of the upper deck to the ceiling, at the limber strake. In the case of a break in the upper deck, the depths are to be measured from a line stretched in continuation of the deck.

3. Divide each of these three depths into five equal parts, and measure the inside breadths at the following points, viz. at one-fifth and at four-fifths, from the upper deck, of the foremost and aftermost depths, and at two-fifths and four-fifths of the midship depth.

4. At half the midship depth measure the length of the vessel, from the after-part of the stem to the fore-part of the stern-post.

5. Then, to twice the midship depth add the foremost and the aftermost depths, for the *sum of the depths*.

6. Add together the upper and the lower breadths at the foremost division; three times the upper breadth, and the lower breadth at the midship division; and the upper, and twice the lower breadth at the after division, for the *sum of the breadths*.

7. Then multiply the sum of the depths by the sum of the breadths, and this product by the length, and divide the final product by 3500, which will give the number of tons for register.

8. If the vessel have a poop or half-deck, or a break in the upper deck, measure the inside mean length, breadth, and height of such part thereof as may be included within the bulk-head. Multiply these three measurements together, and, dividing the product by 92,4, the quotient will be the number of tons to be added to the result as above found.

9. In order to ascertain the tonnage of open vessels, the depths are to be measured from the upper edge of the upper strake.

10. If it be required to find the real capacity of a vessel, multiply the total register tonnage by 92,4, which will give the contents in cubic feet.

Example—Ship Dunira.

LENGTH at half midship depth . . .	159·4	
DEPTH at foremost division	29·66	29·66
„ at midship ditto	30·66 × 2 =	61·32
„ at aftermost ditto	29·08	29·08
Sum of the depths		120·06
BREADTH at foremost division,		
„ at ¼th of the depth	37·74	37·74
„ at ⅓ths of ditto	31·00	31·00
BREADTH at midship division,		
„ at ⅓ths of the depth . . .	40·00 × 3 =	120·00
„ at ⅓ths of ditto	36·08	36·08
BREADTH at aftermost division,		
„ at ¼th of the depth	34·58	34·58
„ at ⅓ths of ditto	17·50 × 2 =	35·00
Sum of the breadths . .		294·40

Then $\frac{294{\cdot}4 \times 120{\cdot}06 \times 159{\cdot}4}{3500}$ = 1609 register tons.

Mean { Length . . . 39 / Breadth . . . 30 / Height . . . 6·5 } of Poop.

Then $\frac{39 \times 30 \times 6{\cdot}5}{93}$ = ... 82

Tonnage as above 1609

Dunira's total register tonnage 1691

If the real capacity be required,
1691 × 92·4 = 156,248 cubic feet.

RULE No. 2.—*For the Measurement of Loaded Vessels.*

Measure the length, on the upper deck, between the after-part of the stem and the fore-part of the stern-post; secondly, the inside breadth, on the under side of the upper deck, at the middle point of the length; and thirdly, the depth from

the underside of the upper deck, down the pump-well to the skin.

Multiply together these three dimensions, and divide the product by 130; the quotient will be the amount of register tonnage.

Example.

	Feet.
Dunira, length of upper deck	163·5
„ breadth	38·7
„ depth.	32·6

Then $\frac{163{\cdot}5 \times 38{\cdot}7 \times 32{\cdot}6}{130} = 1586$ tons.

Poop as before . . . . . = 82

Approximate tonnage . . . 1668

Mode of deducing the Divisor.

In the Official Return to the House of Commons already quoted, the amount of the shipping and tonnage of the United Kingdom is divided into nine classes, the average capacity of each of which has been computed by the Committee from the measurement made by Mr. Cradock, and from other documents.

Now, put l for the average length of the vessels in one class, b for the sum of the breadths, d for the sum of the depths, c for the capacity, and let x be the factor for that class.

Then $c = \frac{lbd}{x}$, therefore $x = \frac{lbd}{c}$; and applying this formula to the several classes where l, b, d, and c are given quantities, the several factors are found to be 36·41 for one class, 37·09 for another, 39·69 for a third, &c. &c.; and the mean for the nine classes is 37·87. Again, the total capacity in cubic feet, of the shipping of the United Kingdom, inferred from the above-mentioned average capacities, and divided by the whole amount of the present registered tonnage, gives 91·654. Then, $37{\cdot}87 \times 91{\cdot}654 = 3473$, and this becomes the required divisor for lbd, in order to preserve the present

proportion of register tons to the real capacity in cubic feet. To simplify the process, however, and at the same time to lean towards the advantage of the ship-owner, the Committee recommend that 3500 be assumed for the legal divisor.

In proceeding to discuss this Report, Mr. Steele says:— "But as I consider several clauses of the Bill to be liable "to serious objections, I shall take the liberty of stating "these objections, and also the means by which it appears "to me they may be obviated. In doing so I am not "actuated by any desire to depreciate the value of the "labours of the Committee, who appear to have paid great "attention to the subject, nor have I any wish to bring for- "ward any favourite plan of my own; my only object being "to do what is in my power to have this important question "settled on a just and sound basis."—P. 8.

After the candour and moderation displayed in this passage, it is to be regretted that the ingenious author of the Report did not give himself time to examine the value of the objections which, at first sight, it seemed so easy to raise; for the distinct manner in which he has brought them into view leaves the writer of these remarks a much easier task than if the measure had been objected to on more general grounds.

Mr. Steele proposes that the upper breadths should all be taken at $\frac{3}{10}$ of the depth from the deck, instead of the points proposed in the Bill. He goes on to say: "It will be seen "from Fig. 1*, that the breadth taken at four-fifths of the "depth is a fair average of the breadth of the lower two- "fifths of the depth; but it is evident that neither the breadth, "at one-fifth from the deck, nor at two-fifths from the deck,

* It was not thought necessary to insert these figures. The first is a midship transverse section of a usual form; the second a bell-shaped section with the mouth uppermost.

" is the average breadth of the upper three-fifths of the " depth, and that the true station for obtaining an average " breadth of the upper three-fifths of the depth is at three- " tenths from the deck, as above stated."—P. 9.

This is too vaguely expressed to discover what conclusion it leads to. By the words *average breadth* we may understand one of two things; either the *arithmetical mean* of two adjacent breadths, which is clearly not allowable in the case of curved sides before us, or a certain equivalent breadth, which, being multiplied by the depth, would give the area of the portion of the section. If he used the latter sense as the ground of his reasoning there would be no objection, but when he admits that " the breadth at F, " or four-fifths of the depth, is the average breadth of the " lower two-fifths," and states that the true station for obtaining an average breadth of the upper three-fifths of the depth is at C, which is three-tenths, or half way down, he is clearly applying terms in a sense of which the subject does not admit.

In Fig. 2 the breadth at one-fifth down exceeds by about 1 foot in 15 feet the breadth at three-tenths, and therefore there is no question that the amendment would diminish the measured capacity. But as Mr. Steele has brought forward nothing in the shape of proof to shew that in vessels of either form the breadths taken as he proposes would give results any nearer the truth than the rule proposed by the Committee, and since he agrees with the Committee that the lower breadth should be at four-fifths where the variation of form is usually still more conspicuous, we need pursue this point no further.

Two reasons shall now be given for having placed the midship upper breadth at two-fifths of the depth, and those of the extreme sections at one-fifth higher.

First—The extreme breadth of most vessels falls within the upper two-fifths of the depth. By taking therefore a

breadth at two-fifths down (there being another at the next two-fifths below it), the increase of breadth for the purpose of evading the rule will be thrown into the upper part of the vessel, thereby tending, whether she is light or loaded, to increase the stability; whereas, if the upper breadth were measured at a higher point, there would arise a temptation to contract the breadth by causing the side to fall in before it came to the point for measurement, because the consequent diminution in the upper or smaller portion of the vessel would be of less consequence than the increase obtained in the lower or larger portion, and thus the stability of vessels would be diminished, and their safety compromised in proportion as they were loaded more deeply—a consideration, surely, of high importance.

Secondly—Since all the sections of a ship take their form more or less from that of the midship section as their origin, it requires no proof to make it evident that the dimensions and form of a vessel must be better obtained by measuring the breadths at different depths than at a uniform depth.

Depth of open vessels.—Mr. Steele is of opinion that it will not be doing justice to open vessels to measure their depth from the upper edge of the upper strake, as vessels of this kind cannot be loaded like decked vessels, and he would recommend five-sixths only of their depth to be considered.

The depth from the upper permanent strake was fixed on because open vessels usually carry wash-boards above it, and if the depth were measured from the gunwale, it appeared to the Committee that the rule might tend to lower it to the prejudice of their safety. It is true that they cannot be loaded like decked vessels; but neither are all decked vessels capable of being loaded alike; and since, in general, open vessels carry more in proportion than decked vessels, there appeared to the Committee no ground for making deductions in their favour.

Doubling and tripling the dimensions.—" It were to be " wished," says Mr. Steele (p. 10), " that the Committee " had stated the principle on which they proceeded in " recommending the multiplying of the dimensions." It may be here observed that the Committee gave, in their Report, only their results, and not the steps by which they had arrived at them. The rule recommended by the Committee was obtained by a process purely *tentative*. It was found that the actual magnitude of two vessels of the same length, depended chiefly on the midship breadth, and that the degree of fulness or sharpness of the bottom depended chiefly on the lower breadth abaft. Hence it was necessary, in order that the rule should afford the contents of vessels of different forms with equal correctness, to give increased weight in the computation to these dimensions; and the numbers combined with these dimensions in the rule, are those which were found on trial to give, in every variety of form, the capacity more nearly than any others.

In reply to a criticism which has proceeded from another quarter, there is no doubt that the rule would have gone forth under a more imposing aspect had it been attended with something like a mathematical demonstration; but it is surely the mere pedantry of science to object, as some have done, that it is deduced only by arithmetical induction. There can be no appeal from the result in either case; and one decisive evidence is as good as another. The analysis of such a question must necessarily be abstruse, and to a great degree uncertain; and if, after all, the conclusions it led to were not identical with those of the humbler process, they must be given up, as not agreeing with observed facts. The Committee, therefore, having before them several plans, in which attempts to proceed on a more direct or scientific basis had led to no better results, and finding also that the indirect rule applied equally well to all possible cases, felt but little hesitation in waving presumptive proof on a matter

which must, after all, be empirical; for since a ship is not a geometrical solid, it follows that no true equation can be a proper expression of the actual content of a ship.

The errors *per cent.* of the rule of the Committee in the vessels measured by authority are here introduced as in evidence of its correctness:—

	Exc.	Def.		Exc.	Def.		Exc.	Def.
Dunira .	„	2.1	Elizabeth	„	1.0	Hawk .	3.6	„
Asia . .	„	0.9	Diadem .	4.4		Liverpool	1.1	„
Palmira .	„	0.3	Columbia	4.8		Deben .	6.3	„
Alexander	„	2.1	Triune	„	0.1	Fanny .	5.3	„
Java . .	„	0.4	Gem . .	„	1.7	Ann . .	„	1.3

The vessels Diadem and Columbia are very full; the Deben and Fanny so much so as to be nearly in the form of boxes.

Mr. Steele, "with other individuals, whose opinions in "such a matter are entitled to the greatest attention," considers these multipliers as liable to great objection, in holding out an inducement to narrow the midship section, and thereby perpetuate the evils already complained of. The argument is specious; but it is matter of arithmetic and not of opinion, and the objection is imaginary, as will presently appear.

Mr. Steele, in considering the probable effects of these multipliers, attached to the midship section, in causing an increase of the dimensions of that section to produce a more conspicuous effect in the tonnage than the same increase of the extreme sections, overlooks the fact that the rule gives in vessels of every form results remarkably near the truth, the error being in the majority of vessels only from 3 to 4 per cent.; and this general fact is an answer to all such objections, because it shews, whatever may be the conclusions drawn from a partial view of the subject, that evasion of any kind must be restricted to very narrow limits, and therefore there is proportionally little temptation to depart from the most approved forms.

We shall not however be content with this general proposition, though it is incontrovertible, but shall now proceed to examine in detail the objection itself.

At p. 11 is the following table, which is intended to shew the "difference on the tonnage which the addition of 1 foot "to the midship dimensions will produce, compared with "the effect of an equal addition to the dimensions of the "fore and after section :—

	FEET.	TONS.	
DUNIRA. Sum of breadths, as stated by Committee, according to the Bill	294		
Tonnage	..	1609	
The addition of 1 foot to midship breadth will make the sum of breadths	297		
And the tonnage	..	1623	
Being an increase of	..	..	14
The addition of 1 foot to fore section will make the sum of breadths	295		
And the tonnage	..	1613	
Being an increase of only	..	..	4
Sum of depths, as stated by Committee	120.06		
Tonnage	..	1609	
The addition of 1 foot to depth in midships will make the sum of depths	122.06		
And the tonnage	..	1634	
Being an increase of	..	..	25
Addition of 1 foot to fore section will make the sum of depths	121.06		
And tonnage	..	1620	
Being an increase of only	..	..	11

This table shews that the addition of 1 foot to the midship breadth would add 14 tons to the register tonnage, while in the foremost breadth it would add only 4 tons. But we are not to infer that a builder will forthwith contract the midship dimensions without first inquiring whether in so doing he may not be evading his own interests instead of the law. Accordingly, if Mr. S. had completed his table by inserting an estimate of the quantity by which the *real* tonnage would be increased by this measure of 1 foot

breadth a-midships, we should have heard nothing further of the objection.

In referring to transverse sections of the Dunira, projected from Mr. Cradock's measurements, if we add half a foot to the upper breadth of the midship transverse section, and trace a new section down to a point a little below the lower breadth, it will be found that the area added will be about 11 square feet. Taking, then, two other sections about half-way between this one and each extreme section, at which the increase of breadth tapers to nothing, the mean area added will be about 7·5 feet, which, multiplied by 109 feet, the distance between the extreme sections, gives 817 cubic feet, which, doubled for both sides, and divided by 92, gives 18 tons nearly, as the rough estimate of the real increase of bulk, while the register tonnage, according to the proposed rule, shews only an increase of 14 tons; so that for the very purpose of evasion it would be desirable to increase the upper midship breadth.

As concerns the depth the grounds of the objection are still weaker. It is shown by the table, and the results are right, that the same increase of 1 foot in the midship depth would increase the register tonnage by 25 tons. Who, then, under the proposed law would increase the midship depth? The temptation to the disproportionate increase of this dimension has been one of the most injurious consequences of the old rule.

As these two serious objections have *à fortiori* established the propriety of the proposed rule, nothing further need be adduced to shew what kind of "encouragement" it will afford to "the building of narrow, straight-sided, mis-shapen vessels," or to quiet the minds of those whose fears for the consequences of the law picture to them the future mercantile navy of Great Britain sailing in the form of *pots*.—P. 11.

It is very easy to see how the old law operated to encourage narrow building, and that the proposed law is

directly opposed to it. In the case before us, where the actual increase of tonnage is 18 tons, the new rule gives an increase of 14 register tons; but the old rule would shew no less than 76. It is true, that by the old rule the extreme breadth being measured, no breadth before or abaft it could be made greater; but the possibility of such distortion urged as an objection against the proposed rule is, after what we have seen, purely speculative*.

Whatever might be the tendency of a rule, as applied to certain imaginable cases, in affecting the forms of vessels, we are to observe that accuracy is the primary consideration, and the tendency to affect forms a subordinate one, because if the rule were quite correct there could be no room for evasion, and, consequently, no temptation to the prejudice of forms. Now, the accuracy of the Committee's rule, regard being had to the small number of dimensions employed, is somewhat remarkable, and this quality of a rule has been too little appreciated.

In page 12 Mr. Steele expresses his opinion that the lower breadth abaft should be taken at a greater height, and that it should not be doubled; but, in answer to this, it is to be observed that the weight assigned to this dimension is that which was found to adapt the rule equally to full vessels and to sharp ones, giving, most commonly, a slight advantage to the latter.

In page 12 Mr. S. "is far from objecting to another section being taken." The only reason worth any consideration that could be brought forward for adding a new section is, that such addition brings with it a proportionally increased accuracy. The proof of this should accompany the sugges-

* Some persons, as appears from the letter of the Dean of Guild, of Dundee, to Sir H. Parnell, have suffered much concern lest the proposed law should cause ships, in process of time, to be built in the forms of *fiddles*.

tion: it should be shewn that the error of the Committee's rule would certainly be reduced in some constant proportion. Now the trouble of taking the measurements (of which Mr. Steele, whose authority must be allowed its weight, thinks lightly) appeared to the Committee by far the most formidable difficulty in the way of framing a rule, and this trouble would be increased by about one-fourth in the rule proposed by Mr. Steele, who prefers four sections to three. But this is not all. If another section be deemed necessary, consistency demands an increased number of breadths at each section, because there is as much difference in the vertical sections of dissimilar vessels as there is in their horizontal sections. Some, therefore, will continue to doubt whether Mr. Steele's rule be even so good for general practice as that already before Parliament; but it was incumbent on him to prove it to be better before he advanced it for the preference of the maritime world.

As at least one additional breadth would be added at each section, this would increase the number of dimensions from 10 to 17; but though the error would thus be diminished, it would not be removed, and therefore, when the true content of a vessel was required, it would be necessary, as it is now, to call in an experienced person to apply the method of equidistant ordinates.

P. 13. In suggesting that, in the event of his alterations being adopted, it would be necessary to find a new divisor, Mr. Steele says,—"Indeed the difficulty is not to find a "divisor, but to find a vessel, or class of vessels, or average "of classes, of such dimensions and formation as shall be a "proper standard, to which, by the divisor, all other vessels "may be reduced." Here we shall observe: if equal weight be given to each dimension, no such pattern vessel will be found as will give a divisor applicable to extreme variations of form, unless the number of dimensions is greater by far than any person of practical views would think of admitting—

five depths and twenty-five breadths would be insufficient for the purpose.

We come now to the divisor. In all the investigations in which the Committee have been engaged on this mixed subject there is none, they believe, that can better undergo examination—none on which they claim less indulgence than the deduction (as far as their evidence went) of this divisor.

The object to be attained is stated in the Report. The *data* for obtaining it are the total tonnage of the kingdom in the Parliamentary Report of April 1830, and the capacities of the vessels measured by authority, with several others, whose contents were furnished by Mr. Palmer, (Appendix to the Report of the Committee, pages 10, 11.) In regard to the total capacity of the merchant-vessels of the United Kingdom, Mr. Steele goes on to say (p. 14), that "although "it were ascertained, and although it should be supposed "(which is by no means certain) that the nine classes into "which the whole shipping is said to have been divided, "really represent all the different formations which are to be "found, yet any conclusion which might be drawn from this "would be far enough from the truth, unless *the whole amount* "*of the tonnage of the vessels in each class were either exactly* "*alike or were taken into account proportionally,* in finding the "relative value of each particular class in reference to the "whole register tonnage. In so far as I understand the ex-"planation given by the Committee, of their mode of finding "the divisor, it appears to me that they have not attended to "this." Now, this *taking into account proportionally* is the very thing the Committee have done, and, so far from thinking with Mr. Steele, that the proposed law will shew a very great increase in the amount of the register tonnage, the effect will be shewn to be rather a decrease.

He then gives the following table of various vessels measured i the Clyde, on which he observes that the tonnage

has been increased in the greater part of them to a very considerable extent, while the decrease on the others, whose tonnage is small, has been comparatively trifling. This result proves nothing more nor less than that the vessels then measured in the Clyde were not distributed according to the average of the whole national tonnage.

Vessels' Names.	Description.	Rise of Floor.	Present Tonnage.	Tonnage by New Bill.	Inc.	Dec.
Ship Saint John,	Wood Drogher,		570	700	130	
Ship now building,	East India Trader,	14 Ins. on 6 Feet.	431½	509½	77½	
Ship Mountstuart Elphinstone,	Do.	18 do. do.	386 91-94ths	435½	49	
Brig Rosalind,	West India do.	13 do. do.	270 58-94ths	304½	34	
Brig Helen,	Newfoundland do.	10 do. do.	129 81 94ths	137½	8	
Ship Leander,	Do.	22 do. do.	187 87-94ths	170		18
Smack Stag,	Liverpool Trader,	10 do. do.	105 82-94ths	103½		2½
Sloop Eliza,	Coaster,	14 do. do.	57 19-94ths	50		7½
Sloop Jessie,	West India Drogher,	21 do. do.	36 77-94ths	31½		5½
				Whole Increase	298	
				Whole Decrease . .		33

In these, he adds, poops and quarter-decks, which have not been included, would swell the amount still more.

Now, in this list of nine vessels we find one large vessel of 570 tons, another of 431, both having (as appears from the result) hitherto been disproportionately underrated, while there are two or three small craft at the other end of the list, whose little increase of tonnage, by a fairer system, can make no set-off against such an overwhelming majority. On the face of it, therefore, a rule that would shew any thing but a *large increase* on this list must be deficient.

These vessels shall now be according to the Parliamentary Report; that is, its proper weight in the average tonnage of the United Kingdom shall be assigned to each vessel, and then a result somewhat different will be obtained.

Classes.	No. of Vessels in the United Kingdom.	Vessels in the Clyde.	Vessels that should have been in the Clyde had they been distributed on the entire average, beginning with the first vessel.*
500 to 800 tons. . . .	110 . .	1 . . .	1
400 to 500	329 . .	1 . . .	3
300 to 400	969 . .	1 . . .	8.8
200 to 300	1948 . .	1 . . .	17.7
100 to 200	3942 . .	3 . . .	35.8
50 to 100	5212 . .	1 . . .	47.4
Below 50	6542 . .	1 . . .	59.4
	Total	9	173

Now the difference of tonnage on the first vessel, that is, on one vessel of the first class, is an increase of 130 tons; on one vessel of the second class an increase of 77½ tons, and so on; hence, if we multiply the number of vessels that we *ought* to have found in each class by the change of tonnage produced on one vessel of the class by the new rule, we shall have the whole change of tonnage that would have been produced by the proposed rule had the vessels been measured in proper proportion.

Change of tonnage produced in one vessel by table.				Increase.	Decrease.
130	×	1	=	130	
77½	×	3	=	232	
49	×	8.8	=	431	
34	×	17.7	=	602	
12	×	35.8	=	. .	430
7½	×	47.4	=	. .	344
5½	×	59.4	=	. .	327
		Total		1395	1151

The difference is an increase of 244 tons, which, being distributed among 173 vessels, shews an increase of something less than one ton and a half on each vessel, as the error of the rule when applied to the whole mercantile navy, exclusive, however, of poops and quarter-decks.

* In order to guard against any possible misunderstanding of this statement, it is meant that, there being one vessel above 500 tons on the list, there ought to be (if it is expected that the rule is to apply as well to these vessels as to the whole national tonnage) 172 more of the subordinate classes.

We shall now take the next table, at p. 16, in the same way, and as that list contains a more uniform distribution of the classes we may expect to find a better result:—

Vessels' Names.	Classes.	Total of Vessels in each Class.	No. of Vessels on the List.	Proportional No., or No. we ought to have.	Change of Tonnage by New Rule.	
					Incr.	Decr.
Dunira...	(Above 1,200)	43	1	1.	266	
Asia.....	From 8 to 12	15	1	.35	207	
Palmira..	„ 5 to 8	110	2	2.55	92	
Alexander.					83	
Java.....	„ 4 to 5	329	1	7.65	74	
Elizabeth.					28	
Diadem ..	„ 3 to 4	969	3	22.54	38	
Columbia.					..	7
Triune ...	„ 2 to 3	1948	1	45.3	27	
	„ 1 to 2	3942	0	91.67		
Gem.....					..	9
Hawk....					..	16
Liverpool.	„ 50 to 100	5212	5	121.21	..	11
Deben ...					..	12
Fanny ...					..	9
Ann	Below 50	6542	1	152.12	..	8
			15	444.4	815	72

Hence, in like manner:—

Change of Tonnage produced in one Vessel.				Increase.	Decrease.
266	×	1	=	266.	
207	×	.35	=	72.4	
87	×	2.55	=	221.8	
74	×	7.65	=	566.1	
19.6	×	22.54	=	441.0	
27	×	45.3	=	1215	
11.4	×	121.21	=	...	1381.8
8	×	152.12	=	...	1217.
				2782	2599

The difference here is an increase of 183 tons, which, being distributed among 444 vessels, gives less than half a ton in excess for each vessel.

These two partial cases shew that the rule cannot be very far wrong, though, from the small number of ships measured, they cannot, of course, afford evidence to correct it.

Mr. Steele remarks, under this latter table, that, "suppose there were 100 vessels in each class represented by "the vessels above-named, the general tonnage would be "increased, by the divisor proposed in the Bill, 81,500 tons, "by those classes whose tonnage would be increased by it, "while the decrease on the other classes would only amount "to 7,200 tons, being less than one-tenth of the increase." It cannot be disputed that if three-decked Indiamen, like the Dunira, were as plentiful as Fannies and Annes, the decrease would be less than the increase; but the supposition itself is gratuitous, and the inference not altogether consistent with fair argument.

The calculation of the divisor will now be given in detail. It is obviously necessary that the divisor for converting capacity into tonnage for register must be such a number as will preserve the sum total of the present register tonnage unaltered; but it neither can nor ought to have the further property of preserving unaltered the tonnage of any particular class.

The mercantile shipping is divided, in the Parliamentary Report of April 1830, into nine classes, according to the number of register tons; hence, if we find in each class the mean divisor which converts the capacity of all the vessels in that class into their register tonnage, such divisor, being multiplied by the total register tonnage of the class, will evidently give the total capacity of the class. Proceeding in this way through the nine classes we shall get, on such averages, the sum total of the capacity of the whole mercantile shipping; this, then, being divided by the total tonnage, will give the required general divisor.

Taking the vessels measured by authority with others at pages 10, 11, of the Appendix, dividing the capacity by the register tonnage of each, we get the divisors annexed:—

CLASS I. (1200 tons and upwards).
Total 59,323 tons.

Reliance	105.4
East Ind. Company's ship	101.1
Dunira	110.3
East Ind. Company's ship	104.7
Mean divisor of 1st Class	105.4

CLASS II. (800 to 1200).
Total 14,467 tons.

Bodden	106.2
Minerva	107.5
East Ind. Company's ship	108.4
Cornwall	104.6
Asia	101.4
Mean divisor of 2d Class	105.6

CLASS III. (500 to 800).
Total 64,344 tons.

Clara	98.3
Duke of Buccleuch	101.
Duke of Northumberland	94.5
East India ship	97.4
Malcolm	106.8
East India ship	100.5
Lady M'Naughten	90.
Protector	110.
Palmira	106.6
Alexander	107.9
Mean divisor of 3d Class	101.3

CLASS IV. (400 to 500).
Total 142,482 tons.

East India ship	104.4
Marquis of Hastings	108.7
Vigilant	98.
Java	109.1
Mean divisor of 4th Class	105.0

CLASS V. (300 to 400).
Total 331,685 tons.

Ethelred	101.1
Lonach	103.0
Valley Field	98.7
Queen Adelaide	97.8
Sir J. Rae Reid	98.5
Prince Rupert	104.2
Endeavour	99.2
Reserve	112.2
Diadem	101.8
Elizabeth	100.3
Columbia	90.4
Mean divisor of 5th Class	100.8

CLASS VI. (200 to 300).
Total 472,128 tons.

Demerica	102.9
Portsmouth Collier	96.6
Triune	104.8
Mean divisor of 6th Class	101.4

CLASS VII. (100 to 200).
Total 555,758 tons.

William	92.3
African Packet	92.4
Boneto	85.9
Eliza	84.4
Lusitania	89.9
Mean divisor of 7th Class	89.

CLASS VIII. (50 to 100).
Total 364,086 tons.

Petworth	76.2
Gem	82.7
Hawk	74.6
Liverpool	79.
Deben	78.2
Alert	69.8
Fanny	77.2
Mean divisor of 8th Class	76.8

CLASS IX. (under 50).
Total 195,686 tons.

Ann	96.3

The mean divisors multiplied by the register tonnage of the class give the capacities:—

		Tons.		Capacity.
105.4	×	59323	=	6264508.8
105.6	×	14467	=	1527715.2
101.3	×	64344	=	6518047.2
105.5	×	142482	=	15031851.0
100.8	×	331685	=	33433840.0
101.4	×	472128	=	47873779.2
89.0	×	555758	=	49462462.0
76.8	×	364086	=	27961804.8
69.3	×	195686	=	13561039.8
Total		2199959		201635056.0

Then the whole capacity divided by the tons = 91.7, the divisor for converting capacity into register tonnage.

Now the number by which the product of the dimensions, according to the rule, is to be divided, in order to make it an expression for capacity, is there stated to be 37.87; hence the whole divisor is 37.87×91.7, or 3472.7, and this is proposed to be simplified by raising it to 3500.

Since the divisor employed, or 3500, is greater than 3473 by something less than 1 per cent., the whole register tonnage will necessarily be diminished by it (in that proportion), and not increased, as it was promised should be proved.

Though the several divisors do not run so uniformly as might appear desirable, yet it is evident, on inspecting them in the above list of 50 vessels, that the general results would be little affected if the irregularities were still greater: hence it is questionable whether the divisor is susceptible of any material improvement, without undertaking the measurement of shipping on a scale almost too extensive to be practicable.

It need scarcely be pointed out that it is not on account of the magnitude of a vessel that the new rule will be against her or in her favour, but on account of her form; that it bears most against high narrow vessels, and will favour low and broad ones. It is also to be remarked,

that the divisor should undoubtedly be in favour of the smaller class of vessels, which, being oftener in and out of port, are more frequently called on for payments levied on tonnage.

With regard to steamers, the Committee considered that, since this class of vessels is so dissimilar in almost every respect from sailing vessels, and since their construction may be expected to differ from time to time, it was advisable to leave the question concerning them open, by the insertion of the clause which recommends an allowance, to be determined from consideration of existing circumstances. It appeared to the Committee that it had been found that the measurement of the engine-room (which nevertheless may after all be the least exceptionable method) had been evaded by shifting the bulk-heads: hence there was no alternative but an arbitrary allowance on the whole tonnage; and the allowance made will be found to give the sum total of the tonnage of the steam-vessels of the United Kingdom as little as possible unaltered by the new rule. On this point it may however be remarked, that these vessels seem to have been hitherto rated too high, and therefore the proposed law would also rate them too high: but this point is a matter for the Legislature. Indeed the quantity of room occupied by the fuel necessary for a voyage of any duration might render an allowance of *one half* the entire tonnage not unreasonable. The light-house dues, which are among the objects of tonnage measurements, affect steam-vessels and sailing vessels differently. Steam-vessels being in a great degree independent of wind and tide, meet with but little interruption, and therefore, generally speaking, make more use of particular light-houses. On the other hand, these vessels, from the celerity with which they perform their voyages, and the certainty of their position at any time, derive little or no advantage from many light-houses,

which are essentially useful to vessels sailing with contrary winds. Perhaps the Legislature might therefore think it fair to allow steam-vessels to commute such charges for an annual payment. The tonnage capacity of the engine-room may be found by multiplying the length, breadth, and depth together, and dividing by 103. The quotient is the number of tons to be deducted from whole tonnage as found by the rule.

With regard to the remark, that "the new rule will dis-"courage the building of new vessels," this is founded on the impression that the general tonnage will be increased, which has been shewn to be erroneous.

The 7th clause leaves it optional with the owners to have their vessels remeasured or not. On this Mr. Steele observes that it will be anomalous, that the tonnage of some merchant-vessels should be measured by a different rule from the rest, and that such vessels only will be remeasured as will register less than they did before. In answer to this it is to be observed, that the anomaly complained of is surely a matter of less consideration than the hardship inflicted on an owner by obliging him to remeasure, on a new scale, a vessel which was built on the faith of an old one, and which, if the new scale had been contemplated, would have been constructed in a different form.

In conclusion, it may be fearlessly asserted, that the rule proposed by the Committee is easy in practice and general in application; that its accuracy is fully sufficient for the required purpose, and as great as can be expected from any approximate process; and that it is not chargeable with any of the objections by which it has been impugned. It has been likewise shewn to be favourable to the amelioration of form, and that, while its tendency will be to encourage the construction of vessels of an opposite kind to those which have become so general from the defects of the old rule,

it will further repress the temptation to accumulate weight aloft in the shape of forecastles and poops; and, therefore, the rule, though no doubt susceptible of future improvement, is entitled to be considered as the only one hitherto proposed which combines all these essential qualities.

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